1,068,067

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,068,067

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Int. Cl.: F 01 c

Reversible compressors, evacuators or motors.

COMPLETE SPECIFICATION

I, MARCEL LOUIS PANIE-DUJAC, of French nationality, of 4 rue Vercingetorix, Paris, Seine, France, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to reversible compressors, evacuators or motors.

According to the present invention there is provided a reversible fluid compressor, evacuator or motor comprising a rotatable wheel carrying a vane, a rotatable disc sealingly engaging the wheel and having a slot through which said vane sealingly passes during rotation of the wheel, and a housing having a fluid inlet and outlet orifices and enclosing in fluid tight manner the volume generated by the vane and the disc during their rotation about their respective axes, the shape of the vane and slot, and the relative positioning of the inlet and outlet orifices being such that, during rotation of the wheel and disc, the common portion of the volume generated by the vane and the volume generated by said disc are constantly and fully occupied either by a part of the disc or a part of the disc and a part of the vane so that these orifices are constantly separated from each other in a fluid tight manner.

An embodiment of a reversible compressor, evacuator or motor according to the invention, hereinafter referred to as the apparatus, will be described with reference to the accompanying drawings, in which:—

Fig. 1 is a perspective view of the apparatus with part of the housing broken away,

Fig. 2 is a perspective view of half the vaned wheel of the apparatus,

Fig. 3 is a perspective view of a distributing disc in the apparatus,

Fig. 4 is a section through the apparatus taken perpendicularly to the axis of the vaned wheel,

Fig. 5 is an axial section through half the vaned wheel,

Fig. 6 is an axial section through half a distributing disc,

Fig. 7 is a diagrammatic elevational view illustrating the circulation of fluids in the apparatus,

Fig. 8 is a plan view of a distributing disc and of the vaned wheel illustrating the relative positions of these two members and

Fig. 9 is a diagrammatic view of the apparatus used in an internal combustion engine.

With reference to Fig. 1, the apparatus comprises a vaned wheel 1 and two abutment or distributing discs 2 rotatably mounted in a housing 3.

The wheel 1 is rotatably mounted on a shaft (not shown) and carries at its periphery two helical vanes 4 which are symmetrically arranged on opposite sides of the wheel 1. The two vanes are set at an angle to the rotational axis of the wheel. Sections through the rim of the wheel 1 and through the vanes 4 in an axial plane (Fig. 5) are convex curves directed towards the centre of the wheel 1; the centres of curvature of the rim of the wheel 1 and the tip of the vanes 4 coincides with the axis of rotation of the discs 2. The vanes may be inclined at any desirable angle to the plane perpendicular to the shaft of the wheel 1.

The two discs 2 are symmetrically disposed on either side of the shaft of the wheel 1. Each distributing disc 2 is rotatably mounted on a shaft (not shown), the shafts of the two discs 2 being perpendicular to the shaft of the wheel 1. Each disc 2 comprises two slots 5 which are symmetrically disposed on either side of the axis of the disc. The slots 5 extend inwardly from the rim of the disc 2, which rim is

discontinuous, towards the centre of the disc.

The walls of the slots 5 may form any desired angle with the faces of the disc.

The housing 3 supports the shafts of the main wheel 1, of the distributing discs 2 and of the synchronising mechanism (not shown). As shown in Figs. 5 and 6, the housing 3 encloses in fluid tight manner the volume generated by rotation of the vanes 4, about the wheel 1, and the discs 2 about their respective shafts. It contains two inlet orifices or apertures 6 and two outlet orifices or apertures 7, the apertures 6 and 7 being defined by a sector of an annulus the centre of which annulus coincides with the centre of said wheel. Each inlet aperture 6 is placed to the rear of a distributing disc 2 in the direction of rotation of the wheel, and each outlet aperture 7 is placed in front of a disc. The apertures 6 and 7 are located on the portions of the housing 3 adjoining the lateral edges of the vanes 4, the inlets 6 being located on one side of the housing 3 and the outlets 7 on the other side.

The synchronising mechanism between the shafts of the disc 2 and of the wheel 1 is not shown and may be formed by any conventional transmission device.

As indicated in Fig. 8 the peripheral edge of each disc 2 engages the concave peripheral edge of the main wheel 1 to form a fluid-tight seal therewith. Similarly when the slots 5 are adjacent to the main wheel the outer peripheral edges of the vanes 4 engage the bottom of the slots 5 to form a fluid tight seal therewith.

The arrangement of the slots 5 and vanes 4, the shapes thereof and the relative movement of the main wheel and of the distributing discs are such that the portions common to the volumes generated by rotation of the vane and of the discs are fully occupied by either a part of a distributing disc or a part of a distributing disc and a part of a vane so that there is always a solid impermeable barrier between the two sides, upstream and downstream relatively to each distributing disc, in the volume swept by the vanes. The relation between a vane 4 and a distributing disc 2 is therefore in the manner of a helical gearing connection, the word "connection" of course being understood in its geometrical sense rather than its mechanical sense since the drive both for the vane and for the distributing disc is external. With the construction described there is no direct communication at any time between the inlet aperture and the outlet aperture located on each side of each distributing disc.

Similarly there is no direct communication between the inlet and outlet located between two distributing discs, since a vane 4 will not expose one of the apertures until the other vane has covered the preceding one.

Since the housing is itself shaped so as to surround the rim or any other part of the wheel 1, such as its shaft, and the volume generated by rotation of the vanes 4 as closely as possible, there is an impermeable barrier to fluids between the portions upstream and downstream of the housing relatively to opposite sides of the housing and relatively to each distributing disc.

The rotational movements of the vanes and distributing discs are synchronised so that the discs allow free passage to the vanes, the latter passing through the slots in the discs and engaging therewith as a function of the gearing geometry mentioned above.

The apparatus may operate as a fluid compressor and evacuator. In this case the shaft of the main wheel 1 drives said wheel 1 to rotate the vanes 4. A vane 4 which has just cleared a distributing disc 2 reaches and passes beyond the inlet aperture located immediately after the disc. As the vane moves away from the disc the volume defined by the housing, the rim of the wheel, the distributing disc and the vane is increased. As this volume is in contact with the outside only through the inlet aperture a suction is produced and external fluids are sucked in (Fig. 7).

As the outlet aperture is exposed by a vane when the following vane simultaneously covers the inlet aperture, fluids located in front of a vane are subjected to pressure and evacuated through the outlet aperture.

The two operations of suction and delivery are thus simultaneous.

The apparatus can obviously operate also as a motor. In this case the fluids in motion or under pressure pass through the inlet aperture and, acting on the vane, drive it until they are themselves forced through the outlet aperture by the following vane. The moment this escape begins the following vane reaches or covers the inlet aperture through which the fluids have passed, and the cycle recommences.

In the two types of operation, as a compressor/evacuator and as a motor the inlets and outlets are opened and closed substantially instantaneously, for they are diametrically opposed and lie between radial lines extending from the centre of the wheel 1.

Suction (or inflow) and delivery (or outflow) are continuous or discontinuous independently of one another, according to whether or not the surfaces of the sides of the vanes completely cover the respective apertures which may be of different dimen-

sions.

In other words, on outflow of the fluids evacuation of a volume bounded by two vanes ends before that of the following volume starts in a case where the shape and area of the side of the vane is at least equal to that of the output aperture; otherwise evacuation of a volume starts before that of the preceding volume terminates. On inflow of the fluids admission is interrupted in the case where the shape and area of the side of the vane is at least equal to that of the input aperture and is not interrupted otherwise.

These properties, on inflow and outflow, are independent assuming that the sections of the respective apertures are differently dimensioned.

Moreover, the geometry of the system is such that the volume between two vanes is never closed but always communicates with two input apertures or two output apertures and such that there is no residual volume either on admission or delivery.

Although the wheel 1 of the apparatus illustrated in the accompanying drawings has only two vanes it may obviously be provided with one or more of these provided that a corresponding number of distributing discs, and input and output apertures are used, each input aperture and end output aperture being located at each side of each disc.

The angle between the rotational axes of the distributing discs and the rotational axis of the vane wheel may have any value.

The effectiveness of the seal between the various members against fluid leakage effectiveness of the barriers provided by the discs and the vanes may be imperfect chiefly as a result of large manufacturing clearances.

The relation between the speeds of rotation of the vane wheel and of the distributing disc or discs is a function of the number of slots in each disc.

The diameters of the vane wheel and the distributing disc or discs are independent of each other and the main wheels of a plurality of devices according to the invention may be mounted on one and the same shaft.

Fig. 9 shows an internal combustion engine comprising a compressor 10 a motor 11 driving said compressor, and two further motors 12 and 13.

Each compressor/motor has a main wheel with two vanes and two distributing discs, each disc having two slots. The vane wheel and the distributing discs in each apparatus rotate at the same angular speed. The axis of each disc and the aligned axes of the vane wheels are perpendicular to one another.

The apertures providing an inlet to the compressor 10 are connected to an inlet pipe 14 through which air enters. When the air has been compressed it leaves through outlet apertures in said compressor and enters two combustion chambers 15 where fuel 16 is injected and ignited by any suitable means 17, 18 such as an electric element or sparking plug. Each of the combustion chambers is connected to the inlet apertures of the motor 11 for driving the compressor, and the gases resulting from combustion actuate the vanes of said motor. The volume swept by the vanes of the motor is greater than that swept by the vanes of the compressor.

On leaving the motor 11 the gases are directed to the two further motors 12 and 13 for further expansion, each outlet aperture of the compressor-driving motor 11 being connected to an inlet aperture in each of the motors. On leaving the motors the gases escape into the atmosphere 19. Two valves 20 enable each or both motors 12, 13 to be brought into or out of operation at will.

The energy thus converted is available as rotational energy of the shaft of the two motors 12 and 13.

WHAT I CLAIM IS:—

1. A reversible fluid compressor, evacuator or motor comprising a rotatable wheel carrying a vane, a rotatable disc sealingly engaging the wheel and having a slot through which said vane sealingly passes during rotation of the wheel, and a housing having a fluid inlet and outlet orifices and enclosing in fluid tight manner the volume generated by the vane and the disc during their rotation about their respective axes, the shape of the vane and slot, and the relative positioning of the inlet and outlet orifices being such that, during rotation of the wheel and disc, the common portion of the volume generated by the vane and the volume generated by said disc are constantly and fully occupied either by a part of the disc or a part of the disc and a part of the vane so that these orifices are constantly separated from each other in a fluid tight manner.

2. A reversible fluid compressor, evacuator or motor as claimed in claim 1 wherein said vane is shaped as part of the helix.

3. A reversible fluid compressor evacuator or motor as claimed in claim 1 or claim 2 wherein the inlet and outlet orifices are respectively positioned immediately upstream and downstream from the disc in the direction of rotation of the wheel so that there is never a volume during rotation of the wheel not communicating with an orifice.

4. A reversible fluid compressor,

evacuator or motor as claimed in any one of the preceding claims wherein the inlet and outlet orifices are defined by a sector of an annulus, the centre of which annulus coincides with the centre of said wheel.

5. A reversible fluid compressor, evacuator or motor as claimed in any one of the preceding claims wherein there are provided a plurality of discs disposed about the wheel, an inlet and an outlet orifice associated with each disc, the relative positioning of the respective inlet and outlet orifices being such that during rotation of the wheel and disc there is never a volume not communicating with an orifice, and these orifices are constantly separated from each other in a fluid tight manner by said discs and said vane.

6. A reversible fluid compressor, evacuator or motor as claimed in claim 5 wherein said wheel carries a plurality of vanes, the number of vanes being the same as the number of discs.

7. A reversible fluid compressor, evacuator or motor as claimed in any one of the preceding claims wherein said wheel and disc are mounted on shafts adapted to be driven by or to drive mechanical means disposed outside the housing.

8. A reversible fluid compressor, evacuator or motor substantially as herein described with reference to and as illustrated in Figs. 1 to 8 of the accompanying drawings.

9. An internal combustion engine comprising a fluid motor as claimed in any one of the preceding claims mechanically connected to a fluid compressor as claimed in any one of the preceding claims to supply compressed air to a combustion chamber, the exhaust gases from said combustion chamber being supplied *via* said motor selectively to a plurality of further motors, the volume swept by the vane of said motor being greater than that swept by the vane of said compressor.

10. An internal combustion engine as claimed in claim 9 wherein said further motors are those claimed in any one of claims 1 to 8.

11. An internal combustion engine as claimed in claim 9 or claim 10 wherein there is provided a valve for selectively bringing one or both of said further motors into or out of operation.

12. An internal combustion engine substantially as herein described with reference to and as illustrated in Fig. 9 of the accompanying drawings.

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FIG. 1

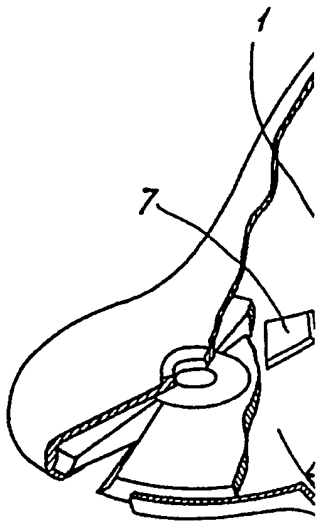
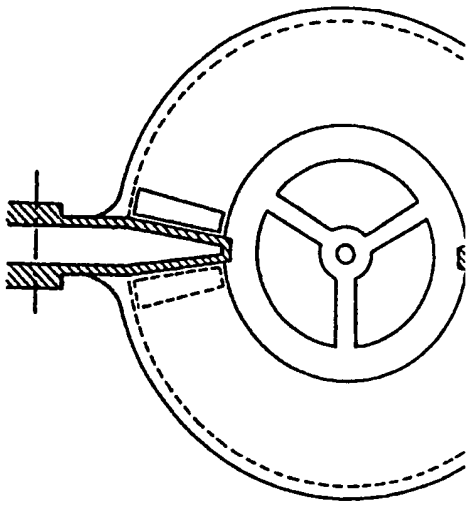


FIG. 4



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2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

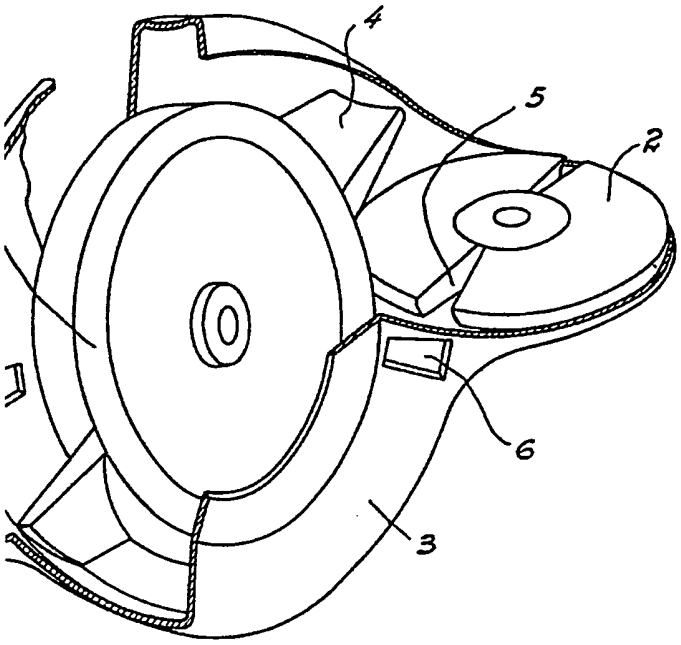


FIG. 5

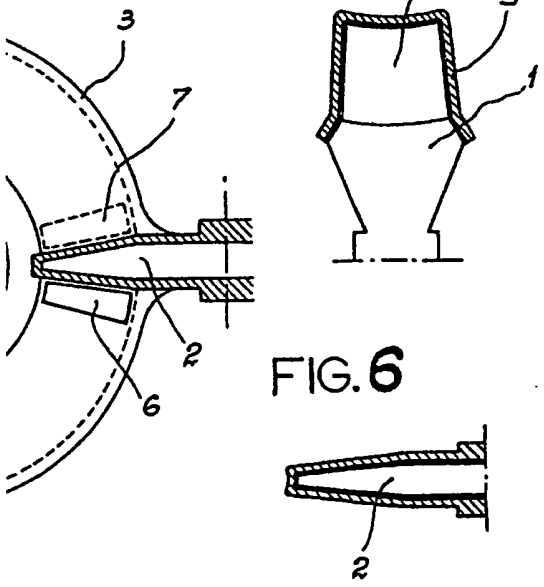
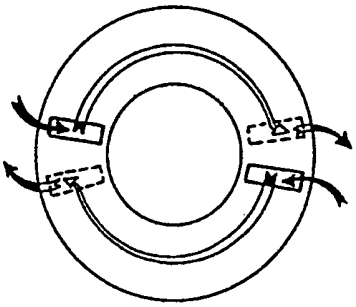


FIG. 6

FIG. 7



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COMPLETE SPECIFICATION

FIG. 1

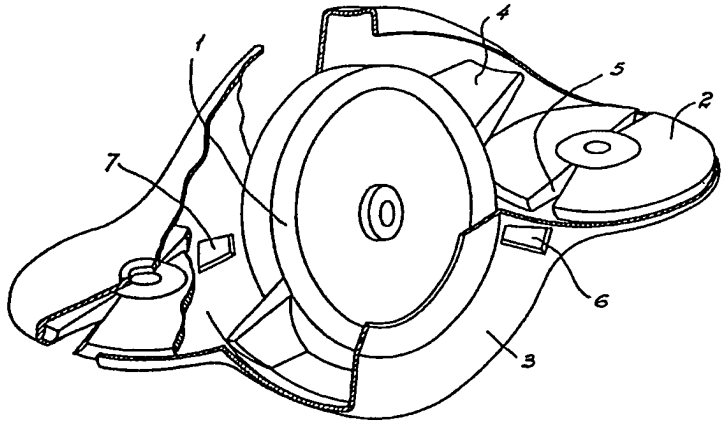

FIG. 4

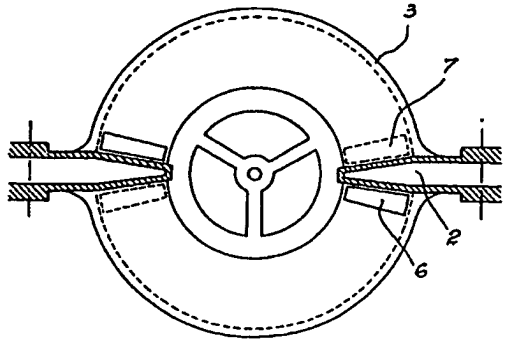

FIG. 5

FIG. 7

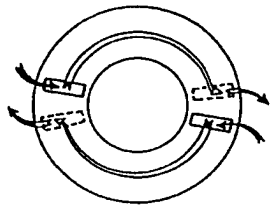

FIG. 6

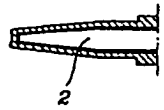

FIG.2

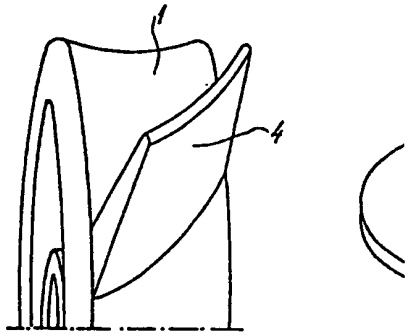

FIG.8

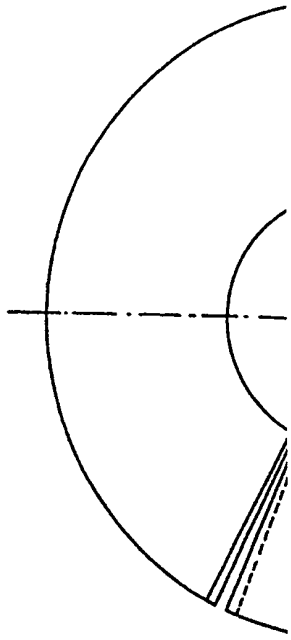

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FIG.9

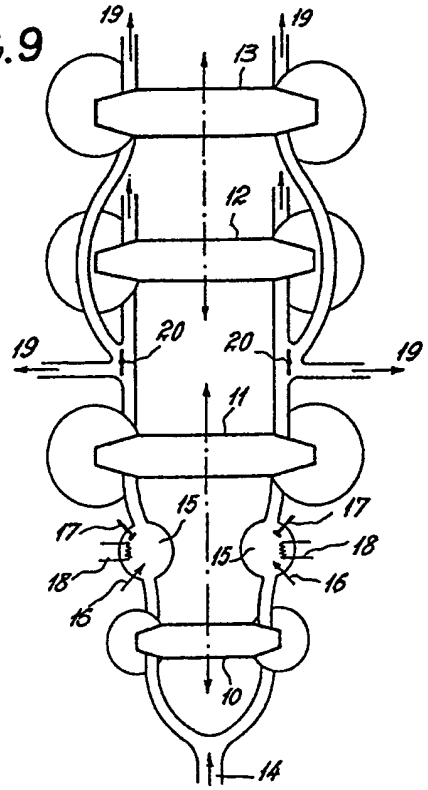
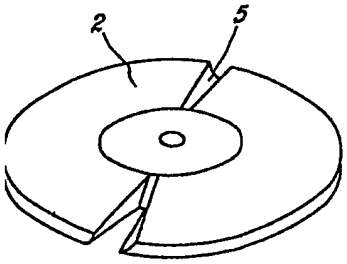
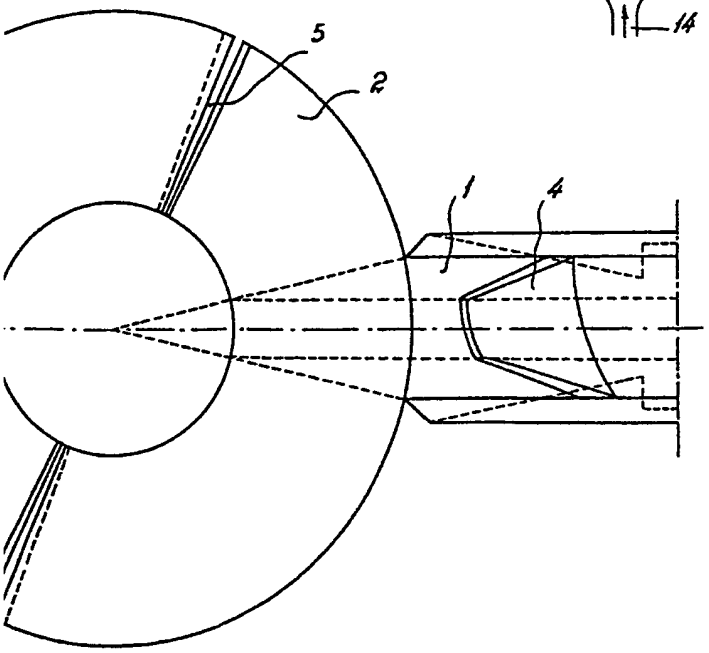


FIG.3





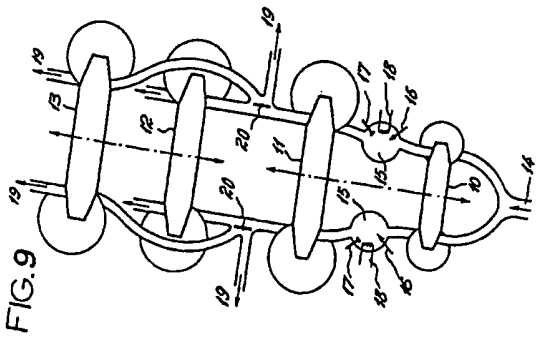


FIG.9

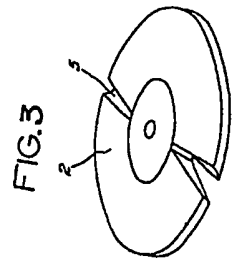


FIG.3

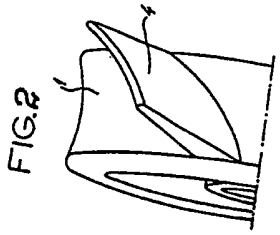


FIG.2

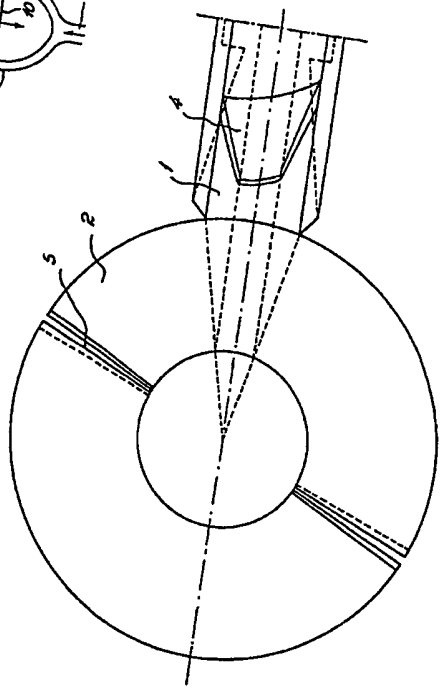


FIG.8